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10/595,273	04/04/2006	Johan Samuel Van Den Brink	PHNL031200US	6580

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EXAMINER	
FETZNER, TIFFANY A	

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2859	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

TH

Office Action Summary	Application No.	Applicant(s)
	10/595,273	VAN DEN BRINK, JOHAN SAMUEL
	Examiner	Art Unit
	Tiffany A. Fetzner	2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *23 April 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *4/4/2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED Final ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on **April 4th 2006** was filed is in compliance with the provisions of 37 CFR 1.97. Accordingly, the examiner has considered the information disclosure statement. The initialed and dated information disclosure statement (IDS) submitted on **April 4th 2006** were previously attached to the office action of January 22nd 2007.

Claim objections

3. **Claims 1-12** are objected to because of the following informalities:

A) In **independent claims 1, 11, and 12,** while it is clear that there are two frequencies being employed by applicant, in applicants k-space acquisition, it is unclear as to whether these frequencies are part of a single pulse sequence, where the frequency changes during a single acquisition as in the case of the variable density spiral acquisitions of the cited prior arts of record below, or whether a first portion / segment / sequence is performed at a first frequency followed by a second portion / segment / sequence being performed between which time the first frequency is changed, as in the **Haase et al.,** prior art applied below. Due to the confusion, over the scope of applicant's invention in this respect, multiple rejections based on the different potential interpretations are provided below. . Appropriate correction (i.e. an amendment clarifying if the frequency change of the invention occurs within a single acquisition sequence, or between separate or repeated acquisition in a multiply portioned / multiply segmented, or multiple acquisition sequence;) is required.

B) The **dependent claims 2-10** are objected to because they depend from **claim 1**.

Response to Arguments

4. Applicant's arguments filed April 23rd 2007 have been fully considered but they are **not persuasive**. The frequencies detected by the prior art are Magnetic resonance frequencies, because magnetic resonance detection is being performed. Additionally

because each resonant nuclei has an intrinsically associated resonant frequency, an intrinsically associated wavelength, and the detection of each MR resonant frequency for a given MR resonance range is the bandwidth for that frequency, the applied prior art is still applicable. The actually recited claims are broader in scope than applicant's arguments, and the examiner is examining the instant application based upon what is actually claimed. Applicant's arguments and the amendments to the claims of the April 23rd amendment and response which add **new claims 13-18** still fail to distinguish over the applied prior arts of record, maintained in the final rejections given below

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Amended Claims 1-5,** and **9-12** are **finally** rejected under **35 U.S.C. 102(e)** as being anticipated by **Moriguchi et al.,** US patent **7,042,215 B2** issued May 9th 2006 filed April 24th 2004, with an effective US priority date from provisional application 60/465,551 of **April 25th 2003**.

7. With respect to Amended system **Claim 1**, corresponding Amended **method claim 11,** and the corresponding **Amended** computer program implementation **claim 12, Moriguchi et al.,** teaches and shows "A magnetic resonance imaging system" [See figure 9, col. 13 line 64 through col. 14 line 53]. The examiner notes that the frequencies utilized each result in magnetic resonance signals being acquired and therefore each frequency utilized by **Moriguchi et al.,** is considered to be a magnetic resonance frequency. **Moriguchi et al.,** teaches and shows an MRI system "comprising an acquisition module" (i.e. a variable Density spiral) "**configured** for acquiring first

magnetic resonance signals for a central portion of k-space using a first **magnetic** resonance frequency" (i.e. f1) "and for acquiring second magnetic resonance signals for a peripheral portion of k-space using a second **magnetic** resonance frequency **different from the first magnetic resonance frequency;**" (i.e. $f1+f_{fat}$) is a separate different MR frequency from the first MR frequency f1. **Moriguchi et al.,** also teaches and shows "a data module **configured** for combining first k-space data corresponding to the first magnetic resonance signals and second k-space data corresponding to the second magnetic resonance signals to form a full k-space and an image module **configured** for generating an image by transformation of **the full** k-space (i.e. negative 200Hz→+200Hz) k-space to image space." [See figures 5a, 5b, 8a, 8b; col. 9 line 15 through col. 10 line 24; col. 10 line 55 through col. 11 line 3; col. 11 lines 32-35; col. 12 lines 32-41; col. 13 line 1 through col. 14 line 53.]. The examiner notes that **Moriguchi et al**. specifically teaches the computer implementation, in col. 13 line 66 through col. 14 line 46.]

8. With respect to Amended **Claim 2**, **Moriguchi et al.,** teaches, "substituting the first k-space data for part of the second k-space data to form a full k-space". [See col. 9 lines 49 through col. 10 line 24 in combination with the mathematics and explanation of col. 5 line 39 through col. 14 line 53, where interleaving and combining the low frequency data at the center of k-space, which is over-sampled; along with the high frequency edge of k-space data which is sampled less, is used to create the low resolution images the blurred combination images, and the demodulated blur corrected resulting images, of fat and water individually.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 2** and need not be reiterated.

9. With respect to Amended **Claim 3**, **Moriguchi et al.,** teaches that "adding the" spiral interleaved "first k-space data to the" spiral interleaved "second k-space data to form a full k-space." ". [See col. 9 lines 49 through col. 10 line 24 in combination with the mathematics and explanation of col. 5 line 39 through col. 14 line 53, where interleaving and combining the low frequency data at the center of k-space, which is over-sampled; along with the high frequency edge of k-space data which is sampled less, is used to create the low resolution images the blurred combination images, and the demodulated

blur corrected resulting images, of fat and water individually.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 3** and need not be reiterated.

10. With respect to Amended **Claim 4**, **Moriguchi et al.,** teaches and shows "acquiring first magnetic resonance signals from protons of water". [See figures 2, 4,col. 2 line 48-58; col. 4 lines 25-39; col. 4 line 64 through col. 14 line 53.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 4** and need not be reiterated.

11. With respect to Amended **Claim 5**, **Moriguchi et al.,** teaches and shows "acquiring first magnetic resonance signals from protons in another substance than H_2O" (i.e. fat or lipid is another substance other than water (i.e. "H_2O"). ". [See figures 2, 4,col. 2 line 48-58; col. 4 lines 25-39; col. 4 line 64 through col. 14 line 53.] The same reasons for rejection, which apply to **claims 1, 4** also apply to **claim 5** and need not be reiterated.

12. With respect to Amended **Claim 9**, **Moriguchi et al.,** teaches and shows "acquiring second magnetic resonance signals from protons of water". [See figures 2, 4,col. 2 line 48-58; col. 4 lines 25-39; col. 4 line 64 through col. 14 line 53.] The same reasons for rejection, which apply to **claims 1, 4** also apply to **claim 9** and need not be reiterated.

13. With respect to Amended **Claim 10**, **Moriguchi et al.,** teaches and shows "acquiring second magnetic resonance signals from protons in another substance than H_2O" (i.e. fat or lipid is another substance other than water (i.e. "H_2O"). ". [See figures 2, 4,col. 2 line 48-58; col. 4 lines 25-39; col. 4 line 64 through col. 14 line 53.] The same reasons for rejection, which apply to **claims 1, 4, 5, 9** also apply to **claim 10** and need not be reiterated.

14. **Claims 1-5,** and **9-12** are **Finally** rejected under **35 U.S.C. 102(b)** as being anticipated by **Haase et al.,** US patent **6,400151 B1** issued June 4th 2002 filed January 13th 2000,

15. With respect to system **Claim 1**, corresponding **method claim 11,** and the corresponding **computer program implementation claim 12, Haase et al.,** teaches and shows "A magnetic resonance imaging system" [See figure 1, the abstract, col. 1

lines 5-11; and col. 17 lines 6-62]. "comprising an acquisition module **configured** for acquiring first magnetic resonance signals for a central portion of k-space using a first **magnetic** resonance frequency" (i.e. See figure 1a, with respect to the k-space acquisition module of sequence "i" in the three bottom figures and the upper left figure; See figure 1a, with respect to the k-space acquisition module of sequence "k" in the top center figure; sequence "i" of figure 1b and especially sequence "**i**" of **figures 1c, 1d**.) "and for acquiring second magnetic resonance signals for a peripheral portion of k-space using a second **magnetic** resonance frequency" The examiner notes that every Magnetically resonant frequency that is detectable intrinsically has a corresponding wavelength and that the magnetic resonance frequency range of a given wavelength is the corresponding bandwidth for that intrinsically associated frequency range. Therefore the presence of different multiple bandwidths, in **Haase et al.,** [See col. 7 line 61 through col. 8 line 4] indicate and imply that multiple magnetic resonance frequencies are present in the **Haase et al.,** reference. [See figures 1a, 1b, 1c, 1d, 4c] Additionally it is clear from figures 1a and col. 7 line 60 through col. 8 line 4 that the second resonance frequency which is used to scan the peripheral edges of kspace is capable of being a resonance frequency "**different from the first magnetic resonance frequency;**" (i.e. See figure 1a, with respect to the k-space acquisition module of sequence "j" in the three bottom figures; See figure 1a, with respect to the k-space acquisition module of sequence "i" in the top center figure; sequence "**j**" of **figure 1b** and especially sequence "**j**" of **figures 1c, 1d**.) "a data module **configured** for combining first k-space data corresponding to the first magnetic resonance signals and second k-space data corresponding to the second magnetic resonance signals to form a full k-space" [See figures 1a, 1b, 1c, 1d; 2b, 3b, 4b; col. 9 line 13 through col. 14 line 51, where the kspace data from the different sequence acquisitions, which have different bandwidths/frequencies completely fill the image space.]; "and an image module **configured** for generating an image by transformation of **the full** k-space to image space." [See col. 1 lines 38-50; col. 12 line 58 through col. 3 line 18; figures 8a, 8b, 9, and 10, which show the resulting full k-space transformed MRI images.] The

examiner notes that the computer implementation is specifically taught by **Haase et al.,** in col. 17 line 7-62; figure 10 and computer component 40.]

16. With respect to Amended **Claim 2**, **Haase et al.,** teaches and shows "substituting the first k-space data for part of the second k-space data to form a full k-space". [See col. 9 line 13 through col. 14 line 51 in combination with the figures of 1a the lower right hand figure, the right hand figure of figure 1c, figure 1d; figures 2b, 3b; where the interleaving and combining of different sequences is shown. Additionally See **col. 12 lines 19-36** one pulse sequence with a small bandwidth at a first low frequency, is used to acquire data at the center of k-space (i.e. the FLASH pulse sequence of figures 3a, 3b), and the other EPI sequence, with a higher bandwidth and a higher frequency acquires the signal data from the edge of k-space (i.e. see the EPI sequence of figures 3a, 3b) which are then combined to create the resulting images, shown in figure 9. See col. 11 line 53 through col. 13 line 38.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 2** and need not be reiterated.

17. With respect to Amended **Claim 3**, **Haase et al.,** teaches that "adding" (i.e. combining) "the first k-space data to the second k-space data to form a full k-space." [See example 2 col. 11 line 53 through col. 13 line 38; figures 3a, 3b, 9, and 1b.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 3** and need not be reiterated.

18. With respect to Amended **Claim 4**, **Haase et al.,** teaches and shows "acquiring first magnetic resonance signals from protons of water". [See col. 16 line 56 through col. 17 line 5, where the technique can be used to suppress either the fat or **water** components of a tissue; See also claim 17 in col. 20 lines 1-7; and the examples 1, 2, 3, and 4; col. 9 line 13 through col. 16 line 47 where numerous combinations and implementations are taught along with figures 1a through 12.] The same reasons for rejection, which apply to **claim 1** also apply to **claim 4** and need not be reiterated.

19. With respect to Amended **Claim 5**, **Haase et al.,** teaches and shows "acquiring first magnetic resonance signals from protons in another substance than H_2O" (i.e. **fat or lipid** is another substance other than water (i.e. "H_2O"))". [See col. 16 line 56 through col. 17 line 5, where the technique can be used to suppress either the fat or water

components of a tissue; See also claim 17 in col. 20 lines 1-7; and the examples 1, 2, 3, and 4; col. 9 line 13 through col. 16 line 47 where numerous combinations and implementations are taught along with figures 1a through 12.] The same reasons for rejection, which apply to **claims 1, 4** also apply to **claim 5** and need not be reiterated.

20. With respect to Amended **Claim 9**, **Haase et al.,** teaches and shows "acquiring second magnetic resonance signals from protons of water". [See col. 16 line 56 through col. 17 line 5, where the technique can be used to suppress either the fat or **water** components of a tissue; See also claim 17 in col. 20 lines 1-7; and the examples 1, 2, 3, and 4; col. 9 line 13 through col. 16 line 47 where numerous combinations and implementations are taught along with figures 1a through 12.] The same reasons for rejection, which apply to **claims 1, 4** also apply to **claim 9** and need not be reiterated.

21. With respect to Amended **Claim 10**, **Haase et al.,** teaches and shows "acquiring second magnetic resonance signals from protons in another substance than H_2O" (i.e. **fat or lipid** is another substance other than water (i.e. "H_2O"). ". [See col. 16 line 56 through col. 17 line 5, where the technique can be used to suppress either the **fat** or water components of a tissue; See also claim 17 in col. 20 lines 1-7; and the examples 1, 2, 3, and 4; col. 9 line 13 through col. 16 line 47 where numerous combinations and implementations are taught along with figures 1a through 12.] The same reasons for rejection, which apply to **claims 1, 4, 5, 9** also apply to **claim 10** and need not be reiterated. [See examples 1, 2, 3, and 4; col. 9 line 13 through col. 16 line 47 where numerous combinations and implementations are taught. See figures 1a through 12.]

Claim Rejections - 35 USC § 103

22. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

23. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

24. **Claims 6, 8** are **Finally** rejected under **35 U.S.C. 103(a)** as being obvious over **Haase et al.,** US patent **6,400151 B1** issued June 4th 2002 filed January 13th 2000, in view of **Van Den Brink et al.,** US publication **2003/0122545 A1** published July 3rd 2003, filed Feb. 19th 2003, which is a divisional application that has an effective US priority date of May 17th 2000.

25. The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

26. With respect to **Claims 6**, and **8 Haase et al.,** lacks directly teaching "acquiring signals from non-proton nuclei" (i.e. **claim 6**) or "from electron spins" (i.e. **claim 8**), in the segmented combinational k-space acquisition sequences such as 3a, 3b, 1a, 1b, 1c, 1d; etc. ... because **Haase et al.,** is most concerned with performing MRI on and

acquiring MRI signals from conventional hydrogen protons within the tissues of a subject . However **Van Den Brink et al**., US Patent application publication **2003/0122545A1** which also teaches a MRI segmentation model for scanning k-space, where like some of the examples of **Haase et al.,** in figures **1a, 1b, 2a, 2b, 3a, 3b**; k-space in **Van Den Brink et al**., is segmented, with the number of segments and the number of lines within each segment for a pre-determined region is adjustable. [See **Van Den Brink et al**., abstract.] Additionally, **Van Den Brink et al**., teaches on page 6 in paragraph 42 that MRI imaging can be performed using electron spins as well as the hydrogen nuclei protons.] Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the MRI proton methodology teachings of **Haase et al.,** with the electron spin teachings of **Van Den Brink et al**., because **Haase et al.,** teaches the ability to utilize at least two different MRI sequences succeeding each other in time and combined, with each sequence differing in at least one of the features of the echo production which is responsible for different aspects of the image quality. [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] Additionally the use of different resonance frequencies, or the detection of different types of nuclei which each would have their own unique resonance frequency, and connects back to having a different resonance frequency being detected by the second sequence, is a feature of the echo signal production that affects the produced image quality. it is also well known in the MRI art to image any of a variety of substances which have a single valent proton or single valent electron, (i.e. such as the noble gases) because it is these molecules or substances such as fluorine, phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

27. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins and other non-hydrogen substances are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a

resonance scan of a non-hydrogen substance desirable, that simply changing the main resonance frequency to the known resonance frequency of the desired non-hydrogen component or substance, enables the acquisition of resonance signals from the non-hydrogen resonant components or substances. Therefore, when it is desirable to image "non-proton nuclei" as in (i.e. **claim 6**) or "electron spins" as in (i.e. **claim 8**), it would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which enables the combining of different MRI sequences and multiple bandwidths / resonance frequencies [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] to also detect additionally resonant substances such as the desired "non-proton nuclei" (i.e. **claim 6**) or to the resonance frequency of the "electron spins" (i.e. **claim 8**) found in **Van Den Brink et al.**, since the ability to detect multiple resonant frequencies in a single combined MRI scan enables more than one component to be detected in the same scan. The examiner notes that because **Haase et al.,** teaches the principle of applying mixed bandwidths and the interchangeability of different pulse sequences which can follow one another, in a single scan, that the ability to detect one type of resonance signal in one location of k-space (i.e. such as the center of kspace), and a different resonance signal in a separate portion of k-space (i.e. such as the outer periphery) is an obvious predicable result. The same reasons for rejection, which apply to **claim 1** also apply to **claims 6, 8** and need not be reiterated.

28. With respect to **New Claims 14, 15**, and corresponding **new claims 17, 18** which depend from Amended **claims 1 and 11** respectively, **Haase et al.,** lacks directly teaching that "the acquisition module is configured to acquire the first magnetic resonance signals from a first nuclear species other than the 1H nuclear species and to acquire the second magnetic resonance signals from the 1H nuclear species" (i.e. **New claims 14, 17**) and **Haase et al.,** lacks directly teaching that "the acquisition module is configured to acquire the first magnetic resonance signals from electron spins and to acquire the second magnetic resonance signals from the 1H nuclear species" because **Haase et al.,** is silent on the specific type of resonating nuclei. However, the ability to combine sequences including a sequence which detects a frequency corresponding to a

separate type of nuclei is suggested since a change in the type of nuclei detected with change the resonant timing of the echoes produced and detected. Additionally the use of different resonance frequencies, or the detection of different types of nuclei which for each sequence may potentially, based of the **Haase et al.,** teachings of col. 6 line 60 through col. 8 line 4, have their own unique resonance frequency, and connects back to having a different resonance frequency / different resonant nuclei being detected by the second sequence, is a feature of the echo signal production that affects the produced image quality. It is also well known in the MRI art to image any of a variety of substances which have a single valence proton or single valence electron, (i.e. such as the noble gases) because it is these molecules or substances such as fluorine, phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

29. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins (i.e. **New claims 15, 18**) and other non-hydrogen substances (i.e. **new claims 14, 17**) are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a resonance scan of a non-hydrogen substance desirable, (i.e. **new claims 14, 17**) along with the conventional hydrogen magnetic resonance signal that simply changing the main resonance frequency to the known resonance frequency of the desired non-hydrogen component or substance, (i.e. **new claims 14, 17**) or the electron spin resonance, (i.e. **New claims 15, 18**) enables the acquisition of resonance signals from the non-hydrogen resonant components or substances. Therefore, when it is desirable to acquire the first magnetic resonance signals from a first nuclear species and to acquire the second magnetic resonance signals from a second nuclear species different from the first nuclear species." it would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which enables the combining of different MRI sequences and multiple

bandwidths / resonance frequencies [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] to detect at least two different resonant nuclei, based upon two different resonant frequencies, since the ability to detect multiple resonant frequencies in a single combined MRI scan enables more than one component to be detected in the same scan. The examiner notes that because **Haase et al.,** teaches the principle of applying mixed bandwidths and the interchangeability of different pulse sequences which can follow one another, in a single scan; that the ability to detect one type of resonance signal in one location of k-space (i.e. such as the center of kspace), and a different resonance signal which may be from a different type of resonating nuclei in a separate portion of k-space (i.e. such as the outer periphery) is an obvious predicable result, . The same reasons for rejection, which apply to amended **claims 1, 11** also apply to New **claims 13, 16** and need not be reiterated.

30. **New Claims 13, 16** are **Finally** rejected under **35 U.S.C. 103(a)** as being obvious over **Haase et al.,** US patent **6,400151 B1** issued June 4th 2002 filed January 13th 2000,

31. With respect to **New Claim 13**, and corresponding **new claim 16** which depend from Amended **claims 1 and 11** respectively, **Haase et al.,** lacks directly teaching that "the acquisition module is configured to acquire the first magnetic resonance signals from a first nuclear species and to acquire the second magnetic resonance signals from a second nuclear species different from the first nuclear species." However, because **Haase et al.,** teaches the ability to utilize at least two different MRI sequences succeeding each other in time and combined, with each sequence differing in at least one of the features of the echo production which is responsible for different aspects of the image quality [See **Haase et al.,** col. 6 line 60 through col. 8 line 4, the abstract] the ability to combine sequences including a sequence which detects a frequency corresponding to a separate type of nuclei is suggested since a change in the type of nuclei detected with change the resonant timing of the echoes produced and detected. Additionally the use of different resonance frequencies, or the detection of different types of nuclei which for each sequence may potentially, based of the **Haase et al.,**

teachings of col. 6 line 60 through col. 8 line 4, have their own unique resonance frequency, and connects back to having a different resonance frequency / different resonant nuclei being detected by the second sequence, is a feature of the echo signal production that affects the produced image quality. It is also well known in the MRI art to image any of a variety of substances which have a single valence proton or single valence electron, (i.e. such as the noble gases) because it is these molecules or substances such as fluorine, phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

32. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins and other non-hydrogen substances are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a resonance scan of a non-hydrogen substance desirable, that simply changing the main resonance frequency to the known resonance frequency of the desired non-hydrogen component or substance, enables the acquisition of resonance signals from the non-hydrogen resonant components or substances. Therefore, when it is desirable to acquire the first magnetic resonance signals from a first nuclear species and to acquire the second magnetic resonance signals from a second nuclear species different from the first nuclear species." it would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which enables the combining of different MRI sequences and multiple bandwidths / resonance frequencies [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] to detect at least two different resonant nuclei, based upon two different resonant frequencies, since the ability to detect multiple resonant frequencies in a single combined MRI scan enables more than one component to be detected in the same scan. The examiner notes that because **Haase et al.,** teaches the principle of applying mixed bandwidths and the interchangeability of different pulse sequences which can follow one another, in a single scan, that the ability

to detect one type of resonance signal in one location of k-space (i.e. such as the center of kspace), and a different resonance signal in a separate portion of k-space (i.e. such as the outer periphery) is an obvious predicable result. The same reasons for rejection, which apply to amended **claims 1, 11** also apply to New **claims 13, 16** and need not be reiterated.

33. **Claims 6, 8** are **finally** rejected under **35 U.S.C. 103(a)** as being obvious over **Haase et al.,** US patent **6,400151 B1** issued June 4th 2002 filed January 13th 2000, in view of **Van Den Brink et al.,** US patent **6,593,740 B1** issued July 15th 2003, filed May 17th 2000.

34. The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

35. With respect to **Claims 6**, and **8 Haase et al.,** lacks directly teaching "acquiring signals from non-proton nuclei" (i.e. **claim 6**) or "from electron spins" (i.e. **claim 8**), in the segmented combinational k-space acquisition sequences such as 3a, 3b, 1a, 1b, 1c, 1d; etc. ... because **Haase et al.,** is most concerned with performing MRI on and acquiring MRI signals from conventional hydrogen protons within the tissues of a subject . However **Van Den Brink et al.**, US Patent application publication

2003/0122545A1 which also teaches a MRI segmentation model for scanning k-space, where like some of the examples of **Haase et al.,** in figures **1a, 1b, 2a, 2b, 3a, 3b**; k-space in **Van Den Brink et al**., is segmented, with the number of segments and the number of lines within each segment for a pre-determined region is adjustable. [See **Van Den Brink et al**., abstract.] Additionally, **Van Den Brink et al**., teaches on col. 11 line 65 through col. 12 line 7 that MRI imaging can be performed using electron spins as well as the hydrogen nuclei protons.] Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the MRI proton methodology teachings of **Haase et al.,** with the electron spin teachings of **Van Den Brink et al**., **Haase et al.,** teaches the ability to utilize at least two different MRI sequences succeeding each other in time and combined, with each sequence differing in at least one of the features of the echo production which is responsible for different aspects of the image quality. [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] Additionally the use of different resonance frequencies, or the detection of different types of nuclei which each would have their own unique resonance frequency, and connects back to having a different resonance frequency being detected by the second sequence, is a feature of the echo signal production that affects the produced image quality. it is also well known in the MRI art to image any of a variety of substances which have a single valence proton or single valence electron, (i.e. such as the noble gases) because it is these molecules or substances such as fluorine, phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

36. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins and other non-hydrogen substances are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a resonance scan of a non-hydrogen substance desirable, that simply changing the main

resonance frequency to the known resonance frequency of the desired non-hydrogen component or substance, enables the acquisition of resonance signals from the non-hydrogen resonant components or substances. Therefore, when it is desirable to image "non-proton nuclei" as in (i.e. **claim 6**) or "electron spins" as in (i.e. **claim 8**), it would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which enables the combining of different MRI sequences and multiple bandwidths / resonance frequencies [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] to also detect additionally resonant substances such as the desired "non-proton nuclei" (i.e. **claim 6**) or to the resonance frequency of the "electron spins" (i.e. **claim 8**) found in **Van Den Brink et al.**, since the ability to detect multiple resonant frequencies in a single combined MRI scan enables more than one component to be detected in the same scan. The examiner notes that because **Haase et al.,** teaches the principle of applying mixed bandwidths and the interchangeability of different pulse sequences which can follow one another, in a single scan, that the ability to detect one type of resonance signal in one location of k-space (i.e. such as the center of kspace), and a different resonance signal in a separate portion of k-space (i.e. such as the outer periphery) is an obvious predicable result. The same reasons for rejection, which apply to **claim 1** also apply to **claims 6, 8** and need not be reiterated.

37. **Claims 6, 7** are **finally** rejected under **35 U.S.C. 103(a)** as being obvious over **Haase et al.,** US patent **6,400151 B1** issued June 4th 2002 filed January 13th 2000, in view of **Salerno et al.**, US patent application publication **2004/0260173 A1** published December 23, 2004, with an effective US priority date of April 13th 2001.

38. With respect to **Claims 6**, and **7 Haase et al.,** lacks directly teaching "acquiring signals from non-proton nuclei" (i.e. **claim 6**) or "from hyperpolarized non-proton nuclei" (i.e. **claim 7**), in the segmented combinational k-space acquisition sequences such as 3a, 3b, 1a, 1b, 1c, 1d; etc. ... because **Haase et al.,** is most concerned with performing MRI on and acquiring MRI signals from conventional hydrogen protons within the tissues of a subject . However **Salerno et al.**, US patent application publication **2004/0260173 A1** teaches MRI imaging of hyperpolarized noble gases, [See **Salerno et**

al., abstract, paragraph [0004] where MRI signals from hyperpolarized helium-3 or xenon-129 signals are acquired. Additionally, the examiner notes that like **Haase et al.,** the frequency of the **Salerno et al**., acquisition as shown in figure 1, changes so that the low initial frequency is used to sample the center of k-space, (i.e. see the oscillation from 0 to –50 cycles to +50 cycles in the first 1600 microseconds of figure 1), and then the dramatic change in frequency from –110 cycles through 100 cycles from the 1600 through 3300 microsecond time frame which samples the edges of k-space. Additionally, Figure 1 of **Salerno et al**., shows the combination of both of these frequencies, combined in a single spiral acquisition sequence because the measurement of cycles/microseconds is a measurement of the k-space sampling frequency. Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the MRI proton methodology teachings of **Haase et al.,** with the hyperpolarized helium-3 or xenon-129 signal acquisitions of **Salerno et al**.,. **Haase et al.,** teaches the ability to utilize at least two different MRI sequences succeeding each other in time and combined, with each sequence differing in at least one of the features of the echo production which is responsible for different aspects of the image quality. [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] Additionally the use of different resonance frequencies, or the detection of different types of nuclei which each would have their own unique resonance frequency, and connects back to having a different resonance frequency being detected by the second sequence, is a feature of the echo signal production that affects the produced image quality. it is also well known in the MRI art to image any of a variety of substances which have a single valence proton or single valence electron, (i.e. such as the noble gases) because it is these molecules or substances such as fluorine, phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

39. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins and other non-

hydrogen substances are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a resonance scan of a non-hydrogen substance desirable, such as hyperpolarized noble gases that simply changing the main resonance frequency to the known resonance frequency of the desired hyperpolarized noble gas enables the acquisition of resonance signals from the hyperpolarized noble gas. Therefore, when it is desirable to image "non-proton nuclei" as in (i.e. **claim 6**) or "hyperpolarized non-proton nuclei" as in (i.e. **claim 7**), it would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which like **Salerno et al**., uses a combined combination of at least two frequencies / or two sequences with each one at a respective frequency; in order to segment k-space into portions where the center of k-space is sampled at one frequency and the edges of k-space are sampled at a different frequency; by altering the resonant frequency to the resonance frequency of the desired "non-proton nuclei" (i.e. **claim 6**) or to the resonance frequency of the desired "hyperpolarized non-proton nuclei" (i.e. **claim 7**) in order to use the **Haase et al.,** MRI method to perform MRI with non-proton nuclei, or hyperpolarized gas. It would have been readily obvious to one of ordinary skill in the art to adapt the known **Haase et al.,** method which enables the combining of different MRI sequences and multiple bandwidths / resonance frequencies [See **Haase et al.,** col. 6 line 60 through col. 8 line 4] to also detect additionally resonant substances such as the desired "non-proton nuclei" (i.e. **claim 6**) or "hyperpolarized non-proton nuclei" as in (i.e. **claim 7**), found in **Salerno et al**., since the ability to detect multiple resonant frequencies in a single combined MRI scan is more efficient and enables more than one component to be detected in the same scan. The examiner notes that because **Haase et al.,** teaches the principle of applying mixed bandwidths and the interchangeability of different pulse sequences which can follow one another, in a single scan, that the ability to detect one type of resonance signal in one location of k-space (i.e. such as the center of kspace), and a different resonance signal in a separate portion of k-space (i.e. such as the outer

periphery) is an obvious predicable result. The same reasons for rejection, which apply to **claim 1** also apply to **claims 6, 7** and need not be reiterated.

40. **Claims 6, 7** are **Finally** rejected under **35 U.S.C. 103(a)** as being obvious over **Moriguchi et al.,** US patent **7,042,215 B2** issued May 9th 2006 filed April 24th 2004, with an effective US priority date from provisional application 60/465,551 of **April 25th 2003** in view of **Salerno et al**., US patent application publication **2004/0260173 A1** published December 23, 2004, with an effective US priority date of April 13th 2001.

41. With respect to **Claims 6**, and **7 Moriguchi et al.,** lacks directly teaching "acquiring signals from non-proton nuclei" (i.e. **claim 6**) or "from hyperpolarized non-proton nuclei" (i.e. **claim 7**), in the segmented variable density spiral k-space acquisition of figures 5a, 5b because **Moriguchi et al.,** is most concerned with performing MRI on and acquiring MRI signals from conventional hydrogen protons within the water and fat tissues of a subject . However **Salerno et al**., US patent application publication **2004/0260173 A1** teaches a variable density spiral MRI imaging of hyperpolarized noble gases, [See **Salerno et al**., abstract, paragraph [0004] and figure 1 where MRI signals from hyperpolarized helium-3 or xenon-129 signals are acquired. Additionally, the examiner notes that like **Moriguchi et al.,** the frequency of the **Salerno et al**., acquisition as shown in figure 1, changes so that a first frequency is used to sample the center of k-space, and then a different frequency rate samples the edges of k-space. Additionally, Figure 1 of **Salerno et al**., shows the combination of both of these frequencies, combined in a single spiral acquisition sequence because the measurement of cycles/microseconds is a measurement of the k-space sampling frequency. Therefore it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the spiral variable density MRI proton methodology teachings of **Moriguchi et al.,** with the hyperpolarized helium-3 or xenon-129 signal acquisitions of **Salerno et al**., because it is well known in the MRI art to image any of a variety of substances which have a single valence proton or single valence electron, because it is these molecules or substances such as fluorine,

phosphorus, carbon 13, helium-3, xenon-129 etc. ... which are capable of exhibiting the phenomenon or magnetic resonance.

42. The most common MRI signal, as is well known in the prior art of record, comes from hydrogen and hydrogen containing molecular substances such as fat, water, or organic tissues, however one of ordinary skill in the art at the time that the invention was made, would have already been aware of the fact that electron spins and other non-hydrogen substances are also capable of exhibiting magnetic resonance. Additionally, it would have been readily obvious to one of ordinary skill in the art at the time that the invention was made that when a specific situation or set of circumstances makes a resonance scan of a non-hydrogen substance desirable, such as hyperpolarized noble gases that simply changing the main resonance frequency to the known resonance frequency of the desired hyperpolarized noble gas, enables the acquisition of resonance signals from the hyperpolarized noble gas. Therefore, when it is desirable to image "non-proton nuclei" as in (i.e. **claim 6**) or "hyperpolarized non-proton nuclei" as in (i.e. **claim 7**), it would have been readily obvious to one of ordinary skill in the art to adapt the known **Moriguchi et al.,** method which like **Salerno et al**., uses a combined combination of two frequencies / or two sequences with each one at a respective frequency; in order to perform an efficient MRI scan which is capable of detecting more than one magnetic resonance frequency and segment k-space into portions where the center of k-space is sampled at one frequency and the edges of k-space are sampled at a different frequency; by altering the resonant frequency to the resonance frequency of the desired "non-proton nuclei" (i.e. **claim 6**) or to the resonance frequency of the desired "hyperpolarized non-proton nuclei" (i.e. **claim 7**) in order to use the **Moriguchi et al.,** MRI method to perform MRI with non-proton nuclei, or hyperpolarized gas. The same reasons for rejection, which apply to **claim 1** also apply to **claims 6, 7** and need not be reiterated.

43. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

44. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Prior Art made of Record

45. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A) **Duerk et al.,** US patent application publication 2005/0017717 A1 published Jan. 27th 2005, filed march 22nd 2004, with an effective US priority date from 60/456,333 of March 20th 2003.

B) **Duerk et al.,** US patent **6,995,560 B2** issued February 7th 2006 which corresponds to **Duerk et al.,** US patent application publication 2005/0017717 A1 published Jan. 27th 2005, that was also filed March 22nd 2004, with an effective US priority date from 60/456,333 of March 20th 2003.

C) **Moriguchi et al.,** US patent application publication 2005/0033153 A1 published Feb. 10th 2005, filed April 26th 2004, with an effective US priority date from 60/465,551 of April 25th 2003.

D) **Mugler III et al.,** US patent application publication 2005/0174114 A1 published Aug. 11th 2005, with an effective US priority date from 60/380,760 of May 15th 2002.

E) **Mugler III et al.,** US patent **7,034,533 B2** issued April 25th 2006 which corresponds to **Mugler III et al.,** US patent application publication 2005/0174114 A1 published Aug. 11th 2005, with an effective US priority date from 60/380,760 of May 15th 2002.

F) **Lai** US patent 6,225,804 B1 issued May 1st 2001.

G) **Rzedzian** US patent 4,767,991 issued August 30th 1988.

H) **Van Den Brink** US patent Application Publication 2005/0279282 A1 published December 14th 2006, filed October 1st 2004 with a EP priority date of Oct. 13th 2003. The examiner notes that this is the publication of applicant's instant application, which is noted for purposes of a complete record only. It is not applicable as prior art.

I) **Meyer et al.,** US patent 5,485,086 issued January 16th 1996.

J) **Meyer et al.,** US patent 5,539,313 issued July 23rd 1996.

K) **Schomberg** US patent 5,604,434 issued Feb. 18th 1997.

L) **Dale** US patent 7,078,899 B2 issued July 18th 2006, filed May 17th 2004, with an effective US priority date of May 15th 2003.

Conclusion

46. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

47. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(571) 273-8300**.

48. Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

T. Fetzner
TAF
August 4, 2007
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8/6/07